

Amendments to the Claims

Please replace the original claim set with the following replacement claim set.

1. (Currently Amended) A flexible unbonded pipe, said pipe comprising at least one polymer layer having a thickness of 4 mm or more and at least one film layer having a thickness of 1 mm or less, said film layer providing a fluid permeation barrier against one or more of the fluids methane, hydrogen sulphides, carbon dioxides and water, which is higher than the fluid permeation barrier provided by the polymer layer determined at 50 °C and a pressure difference of 50 bar, and said polymer layer being bonded to said film layer.

2. (Currently Amended) A flexible pipe according to claim 1 wherein the polymer layer comprises ~~at least 50 % by weight, such as at least 70 % by weight, such as at least 85 % by weight of~~ one or more of the polymers selected from the group consisting of polyolefins, ~~such as polyethylene and poly propylene;~~ polyamide, ~~such as poly amide-imide, polyamide 11 (PA 11) and polyamide 12 (PA 12);~~ polyimide (PI); polyurethanes; polyureas; polyesters; polyacetals; polyethers, ~~such as polyether sulphone (PES);~~ polyoxides; polysulfides, ~~such as polyphenylene sulphide (PPS); polysulphones, such as polyarylsulphone (PAS);~~ polyacrylates; polyethylene terephthalate (PET); polyether-ether-ketones (PEEK); polyvinyls; polyacrylonitrils; polyetherketoneketone (PEKK); copolymers of the preceding[[:]] and fluorous polymers ~~such as polyvinylidene difluoride (PVDF), homopolymers and copolymers of vinylidene fluoride ("VF2 "), homopolymers and copolymers of trifluoroethylene ("VF3 "), copolymers and terpolymers comprising~~

~~two or more different members selected from the group consisting of VF2, VF3, chlorotrifluoroethylene, tetrafluoroethylene, hexafluoropropene, and hexafluoroethylene.~~

3. (Currently Amended) A flexible pipe according to claim ~~1~~ 2 wherein the polymer layer is comprises cross-linked polyethylene (XLPE).

4. (Currently Amended) A flexible pipe according to ~~any one of the claims 1 and 2~~ claim 1 wherein the film layer is of a material selected from ~~materials of~~ the group consisting of polymer, metal, metal containing compositions and combinations thereof.

5. (Currently Amended) A flexible pipe according to claim 4 wherein the film layer is a polymer film comprising one or more of the polymer material selected from the group consisting of polyolefins, ~~such as polyethylene and polypropylene~~; polyamide, ~~such as polyamide-imide, polyamide-11 (PA-11), polyamide-12 (PA-12 and polyamide-6 (PA-6))~~; polyimide (PI); polyurethanes; polyureas; polyesters; polyacetals; polyethers, ~~such as polyether-sulphone (PES)~~; polyoxides; polysulfides, ~~such as polyphenylene sulphide (PPS)~~; polysulphones, ~~such as polyarylsulphone (PAS)~~; polyacrylates; polyethylene terephthalate (PET); polyether-ether-ketones (PEEK); polyvinyls; polyacrylonitrils; polyetherketoneketone (PEKK); copolymers of the preceding[[:]] and fluorous polymers ~~such as polyvinylidene difluoride (PVDF), homopolymers and copolymers of vinylidene fluoride ("VF2"), homopolymers and copolymers of trifluoroethylene ("VF3"), copolymers and terpolymers comprising two or more different~~

~~members selected from the group consisting of VF₂, VF₃, chlorotrifluoroethylene, tetrafluoroethylene, hexafluoropropene, and hexafluoroethylene.~~

6. (Currently Amended) A flexible pipe according to claim 4 wherein the film layer is a metal film ~~preferably~~ selected from the group consisting of aluminum, stainless steel and duplex.

7. (Currently Amended) A flexible offshore pipe according to claim 4 wherein the film layer is a layered material comprising at least one metal layer, ~~such as two, such as three metal layers, the film layer optionally comprising one or more polymeric layers.~~

8. (Currently Amended) A flexible pipe according to claim 4 wherein the film layer comprises metal-containing compositions, ~~preferably selected from the group consisting of metal oxides and metal halides.~~

9. (Currently Amended) A flexible pipe according to ~~any one of the claims 4-8~~ claim 4 wherein the film layer comprises a mixture of polymer with particles selected from the group consisting of carbon particles, metal particles, metal-containing particles, and mixtures thereof ~~and/or metal and/or metal-containing particles.~~

10. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims~~ claim 1 wherein the polymer layer is bonded to the film layer via one or more bondings selected from the group of chemical bondings and physical bondings.

11. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 10 wherein the polymer layer is bonded to the film layer via one or more bondings ~~including~~ comprising at least one of the chemical bondings~~[[,]]~~ selected from the group of ion bondings and covalent bondings.
12. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the bonding between the polymer layer and the film layer is stronger than the internal bondings in one of the polymer layer and the film layer.
13. (Currently Amended) A flexible pipe according to claim 12 wherein the film layer is a layered material, and all interface bondings including bondings between layers of the film and bonding between the polymer layer and the film layer, are stronger than the internal bondings in one of the polymer layer and the film layer.
14. (Currently Amended) A flexible pipe according to ~~claims 12 or 13~~ claim 12 wherein the interface bonding(s) is/are stronger than the internal bonding of the polymer layer.
15. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the interfacial bonding between the polymer layer and the film layer is sufficiently strong to prevent creation of gas pockets between the layers when subjected to an increased carbon dioxides pressure on the film side of the pipe, ~~the increased carbon dioxides pressure e.g. being 1 bar, 5 bars 10, bars or even 50 bars.~~

16. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the bonding between the polymer layer and the film layer has a peel strength using ASTM D3330 of at least 300 N/m, ~~such as at least 500 N/m, such as at least 700 N/m.~~
17. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the bonding between the polymer layer and the film layer is stronger than the cohesive forces in one of the polymer layer and the film layer measured by 90° peel test.
18. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the surface of the film facing the polymer layer comprises a primer, ~~said primer preferably being selected from the group consisting of a plasma deposited layer, a polymer layer added by spraying gluing and/or pressing.~~
19. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the polymer layer has a thickness ~~of at least 4 mm, such as at least 6 mm, such as at least 8 mm, such as at least 10 mm, such as at least 12 mm,~~ preferably the polymer layer has a thickness between 4 and 20 mm, ~~such as between 8 and 15 mm.~~

20. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the polymer layer is at least thicker than the film layer, ~~such as 4 times as thick or more, such as 10 times as thick or more such as 10 times as thick or more, such as 50 times as thick or more, such as up to 100 times as thick~~ thicker than the film layer.

21. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the film layer has a thickness of about 25 μm or more, ~~such as about 100 μm or more, such as about 500 μm or more, such as about 1 mm or less.~~

22. (Currently Amended) A flexible pipe according to ~~any one of the preceding~~ claims claim 1 wherein the film layer provides a fluid permeation barrier against ~~one or more of~~ at least one of the fluids selected from methane, hydrogen sulphides, carbon dioxides and water, which is ~~higher, such as least~~ at least 50 % higher, ~~such as least 100 % higher, such as least 500 % higher, such as least 1000 % higher,~~ than the fluid permeation barrier provided by the polymer layer determined at 50 °C and a pressure difference of 50 bar.

23. (Currently Amended) A flexible pipe according to claim 22 1 wherein the film layer provides a fluid permeation barrier against all of the fluids methane, hydrogen sulphides, carbon dioxides and water, which is ~~higher, such as least 50 % higher, such as least 100 % higher, such as least 500 % higher, such as least 1000 % higher,~~ than the

fluid permeation barrier provided by the polymer layer determined at 50 °C and a pressure difference of 50 bar.

24. (Currently Amended) A flexible pipe according to ~~any one of the claims 22 and 23~~ claim 22 wherein the film layer is essentially impermeable to at least one or more of the fluids selected from hydrogen ~~sulphides~~ sulfides, methane, and carbon dioxide, at a partial pressure for the respective ~~fluids~~ fluid on ~~the~~ a first side of the layer of at least 0.03 bars ~~or more, such as 0.1 bars or more, such as 1 bar or more, such as 10 bars or more~~ measured at about 50 °C and a pressure difference of 50 bar.

25. (Currently Amended) A flexible pipe according to ~~any one of the claims 22 and 23~~ claim 22 wherein the film layer is essentially impermeable to H₂O (~~preferably liquid or gas~~), ~~and~~ measured at about 50 °C and a pressure difference of 50 bar.

26. (Currently Amended) A flexible pipe according to ~~any one of the claims 22-25~~ claim 22 wherein the film layer is essentially impermeable to hydrogen ~~sulphides~~ sulfides at a partial pressure of at least 0.03 bars ~~or more, such as 0.1 bars or more~~ at a temperature of about 25 °C, ~~preferably at a temperature of about 50 °C, preferably at a temperature of about 90 °C, preferably at a temperature of up to about 150 °C~~ and a pressure difference of 50 bar.

27. (Currently Amended) A flexible pipe according to ~~any one of the claims 22-26~~ claim 22 wherein the film layer is essentially impermeable to methane at a partial pressure of at least 1 bar ~~or more, such as 10 bars or more~~ at a temperature of about 25 °C, ~~preferably at a temperature of about 50~~ 25 °C, ~~preferably at a temperature of about 90~~ °C, ~~preferably at a temperature of up to about 150~~ °C and a pressure difference of 50 bar.

28. (Currently Amended) A flexible pipe according to ~~any one of the claims 22-27~~ claim 22 wherein the film layer is essentially impermeable to carbon dioxide, at a partial pressure of at least 1 bar ~~or more, such as 10 bars or more~~ at a temperature of about 25 °C, ~~preferably at a temperature of about 50~~ °C, ~~preferably at a temperature of about 90~~ °C, ~~preferably at a temperature of up to about 150~~ °C and a pressure difference of 50 bar.

29. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims~~ claim 1 wherein said film layer is the innermost layer of said film layer and said polymer layer.

30. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims~~ claim 1 wherein said film layer is sandwiched between two polymer layers, ~~preferably~~ at least one of the polymer layers being bonded to the film layer, with a bonding that is stronger than the internal cohesion of said polymer layer.

31. (Currently Amended) A flexible pipe according to claim 30 wherein the innermost polymer layer of the two polymer layers is selected from the group consisting of polyolefins, ~~such as polyethylene and polypropylene~~; polyamide, ~~such as polyamide-imide, polyamide 11 (PA-11) and polyamide 12 (PA-12)~~; polyimide (PI); polyurethanes; polyureas; polyesters; polyacetals; polyethers, ~~such as polyether sulphone (PES)~~; polyoxides; polysulfides, ~~such as polyphenylene sulphide (PPS)~~; polysulphones, ~~such as polyarylsulphone (PAS)~~; polyacrylates; polyethylene terephthalate (PET); polyether-ether-ketones (PEEK); polyvinyls; polyacrylonitrils; polyetherketoneketone (PEKK); copolymers of the preceding[[:]] and fluorous polymers ~~such as polyvinylidene difluoride (PVDF), homopolymers and copolymers of vinylidene fluoride ("VF2-"), homopolymers and copolymers of trifluoroethylene ("VF3-"), copolymers and terpolymers comprising two or more different members selected from the group consisting of VF2, VF3, chlorotrifluoroethylene, tetrafluoroethylene, hexafluoropropene, and hexafluoroethylene.~~

32. (Original) A flexible pipe according to claim 31 wherein the innermost polymer layer of the two polymer layers being PVDF and the polymer layer on the in radial direction outermost of the two polymer layer is cross-linked polyethylene (XLPE).

33. (Original) A flexible pipe according to claim 31 wherein the innermost polymer layer of the two polymer layers is cross-linked polyethylene (XLPE).

34. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims 1-33~~ claim 1 wherein the film layer is in the form of a tape wound around ~~and optionally bonded to~~ an innermost polymer layer.
35. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims 1-33~~ claim 1 wherein the film layer is in the form of a tape folded around ~~and optionally bonded to~~ an innermost polymer layer.
36. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims 1-33~~ claim 1 wherein said film layer ~~or said film with a primer~~ comprises C atoms, the polymer ~~preferably~~ being a cross-linked polymer with bondings linking to the C atoms of the film layer.
37. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims 1-33~~ claim 1 wherein said pipe comprises one or more innermost unbonded armouring layers (carcass).
38. (Currently Amended) A flexible pipe according to ~~any one of the preceding claims 1-33~~ claim 1 wherein said pipe comprises at least one ~~or more~~ unbonded armouring layers ~~(outer armouring layers)~~ layer on the outer side of the polymer layer bonded to said film layer, ~~preferably an outer cover layer being placed around said outer armouring layers.~~

39. (Currently Amended) A method of producing a flexible unbonded pipe as defined in ~~any one of the claims 1-38~~ claim 1, said method ~~comprising~~ comprises the steps of providing at least one polymer layer and at least one film layer and bonding said layers to each other.

40. (Currently Amended) A method according to claim 39 said method ~~comprising~~ comprises the steps of

-providing an innermost polymer layer, ~~preferably around a mandrel or an inner armour layer (carcass), more preferably by~~ using a method selected from extrusion, winding, or wrapping,

-providing a film layer around said innermost polymer layer, ~~preferably by~~ using a method selected from extrusion, winding, or wrapping,

-providing a second polymer layer around said film layer, ~~preferably by~~ extrusion, and

-providing a bonding between at least one of said polymer layers and said film layer, ~~said bonding preferably being provided by~~ subjecting said at least one polymer layer to cross-linking.

41. (Currently Amended) A method according to claim 39 said method comprising the steps of

-providing a film layer around a mandrel or an inner armour layer (carcass), ~~preferably by~~

using a method selected from extrusion, winding or and wrapping,

-providing a polymer layer around said film layer, ~~preferably~~ by extrusion, and

-providing a bonding between said polymer ~~layers~~ layer and the said film layer, ~~said bonding preferably being provided by cross-linking of the polymer layer.~~

42. (Currently Amended) A method according to claim 39, said method comprising the steps of

- providing ~~the~~ an innermost layered section of the flexible pipe comprising at least an innermost polymer layer and an armour layer on the outer side of said innermost polymer layer,

-providing a film layer around said innermost layered section of the flexible pipe, ~~preferably by extrusion, winding or wrapping,~~

-providing an outer polymer layer around said film layer, ~~preferably by extrusion,~~ and

-providing a bonding between at least one of said polymer layers and the said film layer, ~~said bonding preferably being provided by subjecting said polymer layer to cross-linking.~~

43. (Currently Amended) A method according to ~~any one of the claims 39-42~~ claim 39 wherein the film layer is treated by corona or by application of a primer for increasing bonding, ~~said primer preferably being applied using CVD, spraying, dipping and/or~~ rolling strength.

44. (Currently Amended) A method according to ~~any one of the claims 39-43~~ claim 39 wherein the film layer or a primer coated onto said film layer comprises C atoms.

45. (Cancelled)

46. (Currently Amended) A method according to ~~any one of the claims 39-45~~ claim 39 wherein the film layer ~~is or~~ comprises a metal tape with a primer, ~~the primer preferably being selected from the group of latex primers, epoxy primers and acrylat/methacrylat primers.~~

47. (New) A method according to claim 40 wherein said bonding is provided by subjecting said at least one polymer layer to cross-linking.

48. (New) A method according to claim 42 wherein said bonding is provided by cross-linking of said polymer layer.

49. (New) A method according to claim 42 wherein said bonding is provided by subjecting said polymer layer to cross-linking.

50. (New) A flexible unbonded pipe, said pipe comprising at least one polymer layer and at least one film layer, said film layer being a metal film layer and said polymer layer being bonded to said film layer.

51. (New) A flexible unbonded pipe, said pipe comprising at least one polymer layer and at least one film layer, said polymer layer being bonded to said film layer, and the interfacial bonding between the polymer layer and the film layer being sufficiently strong to prevent creation of gas pockets between the layers when subjected to an increased carbon dioxide pressure of 5 bar on the film side of the pipe.

52. (New) a flexible unbonded pipe according to claim 50, wherein the bonding between the polymer layer and the film layer has a peel strength using ASTM D3330 of at least 300 N/m.

53. (New) A flexible unbonded pipe, said pipe comprising at least one polymer layer and at least one film layer, said polymer layer being thicker than said film layer, said film layer being a wounded or folded film layer, and said polymer layer being bonded to said film layer.

54. (New) A flexible unbonded pipe, said pipe comprising at least one polymer layer and at least one film layer, said polymer layer being a cross-linked polyethylene and said polymer layer being bonded to said film layer, and said bondings being established by the cross-linking of the polyethylene.